इंटरनेट मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”
Mazdoor Kisan Shakti Sangathan
“The Right to Information, The Right to Live”

“पुराने को छोड नये के तरफ”
Jawaharlal Nehru
“Step Out From the Old to the New”

IS 13736-3-0 (1993): Classification of Environmental Conditions, Part 3: Classification of Groups of Environmental Parameters and their Severities, Section 0: Introduction [LITD 1: Environmental Testing Procedure]

“ज्ञान से एक नये भारत का निर्माण”
Satyanarayan Gangaram Pitroda
“Invent a New India Using Knowledge”

Act Number 22 of 2005
The Indian Parliament
RIGHT TO INFORMATION

Made Available By
Public.Resource.Org

“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”
Bhartṛhari—Nītiśatakam
“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE

BRUTUM FULMEN
IGNORANTIA JURIS NON EXCUSAT
PROTECTED BY COPYRIGHT

IS 13736 (Part 3/Sec 0) : 1993
IEC Pub 721-3-0 (1984)

भारतीय मानक

पर्यावरण अवस्थाओं का वर्गीकरण

भाग 3 पर्यावरण पेरामीटर और उनकी कठोरताओं के समूहों का वर्गीकरण

अनुभाग 0 परिचय

Indian Standard

CLASSIFICATION OF ENVIRONMENTAL CONDITIONS

PART 3 CLASSIFICATION OF GROUPS OF ENVIRONMENTAL PARAMETERS AND THIER SEVERITIES

Section 0 Introduction

UDC 621·38·038 : 620·193

© BIS 1993

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

June 1993 **Price Group 5**

Environmental Testing Procedures Sectional Committee, LTD 02

NATIONAL FOREWORD

This Indian Standard, which is identical with IEC Pub 721-3-0 (1984) 'Classification of environmental conditions — Part 3 : Classification of group of environmental parameters and their severities, Introduction', issued by the International Electrotechnical Commission, was adopted by the Bureau of Indian Standards on the recommendation of the Environmental Testing Procedures Sectional Committee (LTD 02) and approval of the Electronics and Telecommuication Division Council.

The text of the IEC standard has been approved as suitable for publication as Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

> Wherever the words 'International Standard' appear, referring to this standard, they should be read as 'Indian Standard'.

The concerned technical committee has reviewed the provisions of IEC 68, referred in this standard and has decided that it is acceptable for use in conjunction with this standard.

Part 1 of this Indian Standard deals with classification of environmental parameters and their severities. The subsequent parts are intended to deal with the following:

a) Environmental conditions appearing in nature

b) Classification of groups of environmental parameters and their severities.

Amendment No. 1 issued to IEC Pub 721-3-0 (1984) is given at the end.

Only the English language text in the International Standard has been retained while adopting it in this Indian Standard.

Indian Standard

CLASSIFICATION OF ENVIRONMENTAL CONDITIONS

PART 3 CLASSIFICATION OF GROUPS OF ENVIRONMENTAL PARAMETERS AND THIER SEVERITIES

Section 0 Introduction

Scope

IEC Publication 721-3: Classification of Environmental Conditions, Part 3: Classification of Groups of Environmental Parameters and Their Severities, establishes classes of environmental parameters and their severities, covering the extreme (short-term) conditions which may be met by a product when being transported, installed, stored and used. Separate groups of classes are given for different product applications (e.g. weather-protected stationary, mounted in ground vehicles, transportation). The classes also take into account the degree of restriction of the use of the product from very restricted conditions (e.g. in temperature-controlled rooms) to unrestricted conditions.

The classification covers natural as well as man-made conditions.

2. Object

This Introduction is a guide for the use of all parts of IEC Publication 721-3. It contains background information including information on application and limitation of the classes given in various parts of IEC Publication 721-3. It describes the difference between the environmental conditions the product will meet during its life, described by the classes in IEC Publication 721-3, and conditions of test used to assure that the product will work satisfactorily under such environmental conditions. The use of IEC Publication 721-3 in the design, limitation of conditions and protection is also included. The differences are explained between extreme environmental conditions with a small probability of being exceeded, normally approached only for short periods, and more long-lasting normal environmental conditions.

Reference to IEC Publication 721-3-0 is strongly recommended in order to avoid misuse of the classes defined in the other parts of IEC Publication 721-3.

3. Content and layout

Separate groups of classes of environmental conditions are given for the following product applications:

Publications 721-3-1: Storage;
721-3-2: Transportation;
721-3-3: Stationary Use, Weather-protected;

721-3-4: Stationary Use, Non-weatherprotected;

721-3-5: Ground Vehicle Installations;

721-3-6: Ship Environment;

721-3-7: Portable and Stationary Use.

The classes are identified by:

- a digit defining the application (1 for storage, 2 for transportation, 3 for stationary use, etc.);
- a letter for climatic conditions (K), biological conditions (B), chemically active substances (C), mechanically active substances (S) or mechanical conditions (M). To be extended if necessary;
- a further digit indicating severity, where a higher digit normally indicates more stringent conditions. A class may be further divided into H (High) or L (Low) to allow for conditions where, for example, the temperature may be severely low but never high.

Example: Class 2K3, where: 2 = transportation;
K = climatic conditions;
3 = severity.

The parts of IEC Publication 721-3 contain tables giving all classes, including the severity of each environmental parameter for each class. In addition, every publication includes an appendix giving details of conditions which products are assumed to meet and which form a basis for the classes. These appendices are intended to guide the user of the publication in his selection of the class appropriate to his special product application.

4. Background information for the selection of environmental parameters and severities for the classes

The environmental parameters listed for a class are the conditions covered by the class to which a product will be subjected. They are selected by using the complete set of environmental parameters in IEC Publication 721-1: Classification of Environmental Conditions, Part I: Classification of Environmental Parameters and Their Severities, as a "check list".

The severities given for each environmental parameter are those which are exceeded either for an insignificant part of the continuous exposure time (e.g. temperature conditions), or for an insignificant fraction of the total number of events (e.g. shocks). Thus the classes given in IEC Publication 721-3 can be used for defining the maximum short-term environmental stresses of a product, but do not give any information on the long-term, or total life duration of the product environmental stresses. This is illustrated in Figure 1, page 11.

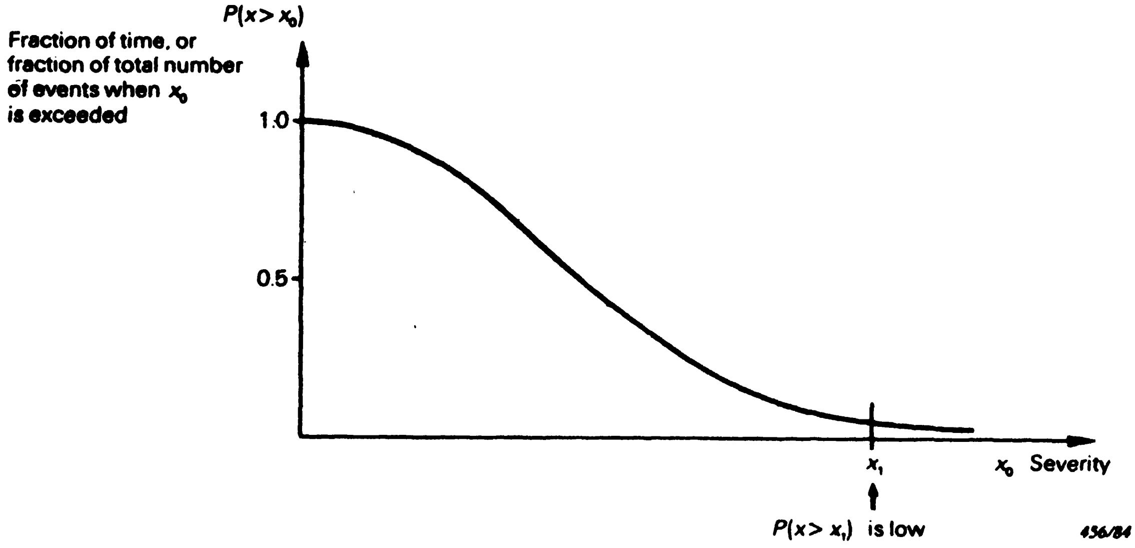

FIG. 1. — Illustration of the fraction of time or fraction of the total number of events when a certain environmental severity is exceeded.

The severities given in the classification are represented by one value x_1, whilst the information needed for defining the totality of environmental stresses during the lifetime of a product includes the total curve, $P(x > x_0)$ for all values of x_0.

Although available data do not make it possible to give an exact figure on the probability level used in the classification, $P(x > x_1)$ is usually considerably less than 0.01.

A product will be simultaneously exposed to a large number of environmental parameters. Some of the parameters are statistically dependent, for example, low air velocity and low temperature, sun radiation and high temperature. Other parameters are statistically independent, for example vibration and temperature (normally).

The probability of simultaneous exposure to extreme severities of independent environmental parameters x and y is equal to the product of the probabilities of exposure to each of the parameters, i.e.:

$$P(x, y > x_1, y_1) = P(x > x_1) \cdot P(y > y_1)$$

Example: If the probability of exceeding each of the parameters

$$P(x > x_1) = P(y > y_1) = 0.01, \text{ then } P(x, y > x_1, y_1) = 0.0001$$

It should be noted that in many cases the product is exposed for only limited periods to the environment from which the statistical data have been collected. In such cases severities in the classification have been selected which have a probability higher than 0.01 of being exceeded. Consequently, the probability of the combination of the product being exposed to the environment and of the class limit severity is reasonable (in the order of magnitude of 0.01).

5. Guidance for the use of IEC Publication 721-3

5.1 *General*

All products have to be designed to survive and work in more or less severe environments. Basically they will be affected by the environmental influences in two ways:

- by the effects of short-term extreme environmental conditions, which may directly cause malfunction or destroy the product;
- by the effect of long-term subjection to non-extreme environmental stresses, which may slowly degrade the product and finally cause malfunction or destruction of the product.

The short-term extreme environmental conditions, defined in IEC Publication 721-3, may occur at any time in the product's life. A product may be unaffected by an extreme condition when it is new but fail when it is subjected to the same condition after being used for a long period due to the effect of ageing.

Extreme conditions may affect the product:

- only when the product is non-operating (e.g. during storage and transportation),
- only when the product is operating,

or both. It is therefore important for the product specification, when referring to a certain class in IEC Publication 721-3, to define whether the product is required to be capable of operating or only to survive without permanent damage, when being subjected to the conditions described by the class.

The environmental classes may be used as a basis for the choice of design and test levels. This does *not* imply that the class limits should be used as design and test levels, nor that zero failure rate should be required at the class limits. Design and test levels must always be chosen from case to case with respect to acceptable risk of failure, i.e. with higher or lower severity depending on expected consequences of failure.

5.2 *In the design, limitation of conditions and protection*

IEC Publication 721-3 is basically intended to be used as a basis for defining the actual environmental conditions for which a product has to be designed. The designer must be aware that the physical influence of environmental conditions may be the result of a certain number of environmental parameters.

Example: The highest temperature achieved on the surface of a product may be the result of the combination of the temperature of the surrounding air, solar radiation, heat radiation from a nearby heating element, open oven, etc.

The manufacturer or user of the product may reduce the severity of an environmental parameter by protecting the product, for example, by using an enclosure for transportation and storage or by mounting the product on vibration or shock isolators. The environmental severities given by the classes in IEC Publication 721-3 shall then be applied to the product including its protection, not to the product itself.

By means of the information given in the appendices to the various parts of IEC Publication 721-3 it is possible for the manufacturer and user to define restrictions in the transportation, storage or use of the product, which will bring the application into compliance with a lower severity class.

It is often economical and technically important to find an optimum between:

- the environmental resistance of the unprotected product;
- the protection of the product from environmental influences;
- restrictions in transportation, storage and use of the product.

It should be noted that an overdesign of a product, in order to withstand environmental conditions more extreme than necessary, does not necessarily result in higher reliability. An overdesign or unnecessary built-in protection may lead to a more complex product with an increased number of failure modes. Furthermore, overdesign of products as well as unnecessary requirements on locations in order to ensure environmental conditions less severe than necessary, can become very expensive.

5.3 *For defining appropriate levels for qualification testing*

As mentioned under Sub-clause 5.2 above, the classes in IEC Publication 721-3 can be used as basis for design, protection and introduction of restrictions. Demonstration of the capability of the product to meet the environmental condition includes a number of activities, from instructions for selection of basic materials used in the product including material testing, instructions for surface treatments, etc., to testing of samples of the complete product under simulated environmental conditions.

The testing is made in a selection of the environmental parameters, or sometimes combinations thereof, which may be detrimental to the product. An environmental test requirement is described by:

- environmental parameter;
- testing procedure;
- testing severities.

In addition requirements are given related to the specific product, for example rating, functional requirements, acceptable degradation etc.

Environmental testing procedures for testing are standardized in IEC Publication 68: Basic Environmental Testing Procedures.

The severities used for testing must be related to the testing procedure, which attempts to produce the effects of the actual environment. This reproduction is often different from the actual environmental conditions.

Examples: — A high temperature test on a heat dissipating product is designed to simulate the thermal effect of subjecting it to conditions of high air temperature, solar radiation and other possible heat sources dependent on the application.

— In a shock test, the product is subjected to shocks of simple pulse shapes (e.g. half-sine), whilst the actual conditions cannot be described by such simple pulses. A transformation by means of comparing the shock spectrum of the actual conditions with the shock spectrum of the test pulse is needed.

(The transformation of actual conditions into test conditions is not within the scope of IEC Publication 721.)

The conditions given in IEC Publication 721-3 are those with a small probability of being exceeded but without safety margins. In addition to selection and transformation of actual conditions into test conditions the designer of test requirements can add margins to cover:

- tolerances of test equipment and control devices;
- inequalities between the sample used for testing and other specimens of the product;
- other factors.

As a summary it is emphasized that the classes in IEC Publication 721-3 define actual extreme environmental conditions. They should not be directly applied for qualification testing. They may, however, be used as basic material for defining test levels for such testing, together with methods for transformation of actual conditions into test conditions, safety margins, etc.

Amendment

No. 1
April 1987
to

Publication 721-3-0
1984

Classification of environmental conditions

Part 3:
Classification of groups of environmental
parameters and their severities
Introduction

Page 1

Add to Clause 2: Object, after the first paragraph insert the following:

This Introduction also gives guidance for applying factors of duration and frequency of occurrence in characterizing the contribution of a significant parameter of a class.

Page 6

Add the following clause:

6. Duration and frequency of occurrence

6.1 *General*

The severities specified in the classes of IEC Publication 721-3 are those which will have a low probability of being exceeded. They occur for only a fraction of time or for a limited number of events.

For certain applications it may be important to know how long or how often significant levels of environmental parameters bear upon the product. Depending on the local situation or on the use profile of a product, duration or frequency of occurrence of single environmental parameters may be different. The knowledge of the expected duration or frequency of occurrence may significantly influence the design of the product or protective measures (details of building construction, etc.) at the location of application (during storage, transportation or use).

The underlying problems are often of a statistical and very complex nature. Such situations cannot be dealt with in a standardized manner. The following tables and examples can only convey a limited amount of information. They should therefore be used only in simple cases or when no more relevant information on durations is available.

6.2 *Duration and frequency of occurrence*

6.2.1 Table I contains a standard selection of total durations which may be related to each application.

6.2.2 Table II contains a standard selection of maximum durations of a single occurrence, and Table III contains a standard selection of durations of occurrence or number of events per unit time. These durations or frequencies may be related to each environmental parameter of a class normally characterizing the situation when the contribution of that parameter is significant.

Depending on the situation, the term "significant" is considered in this text to cover situations such as the following:

- the state described by the parameter is reached, for example, condensation, icing, etc.;
- the parameter value is beyond the corresponding severity of the next lower class, for example, low air pressure, high air temperature, low relative humidity, high relative humidity, etc.;
- the parameter exceeds any defined threshold value, which then has to be stated together with the duration or frequency selected.

A relationship between the durations and frequencies of Table II and Table III, and the total durations of application in Table I may be given.

6.2.3 Appendix A gives examples of application of standard values of duration and frequency of occurrence.

TABLE I
Total duration of application

Application	Duration				
Storage	1 month	6 months	1 year	2 years	3 years
Transportation	24 h	1 week	1 month	6 months	
Use	1 year[1)]	5 years	10 years	20 years	40 years

1) Exceptional cases may call for a very short duration, for example weather sondes.

TABLE II

Maximum duration of single occurrence

1 s
10 s
1 min
0.5 h
1 h
8 h
24 h
1 week
2 weeks
1 month

TABLE III

Frequency of occurrence

Duration of occurrence per unit time[1]		Number of significant events per unit time [1]
0.5 h		1
1 h		2
8 h	or	5
24 h		10
1 week		
2 weeks		
1 month		
2 months		
6 months		

---

[1] Unit time to be selected from the following: second, minute, hour, 24 h, week, month, year.

APPENDIX A
EXAMPLES OF APPLICATION

Application of the standard values of duration and frequency of occurrence to actual cases is exemplified in the following:

A1. *Example No. 1*

The product will be transported by normally available transportation means from the manufacturer to the user over a long distance without special care or protection.

Environmental classification:	2K4/2B2/2C3/2S2/2M3
Duration of transportation:	1 month
Duration of significant vibration:	1 week per month
Number of significant shocks:	1 per h
Number of significant free falls:	10 per month

A2. *Example No. 2*

The product is to be used in a weatherprotected stationary installation.

Environmental classification:	3K3/3Z1/3B1/3C2/3S2/3M2
Duration of use:	10 years
Duration of significant vibration:	1 week per year
Maximum duration of significant vibrations:	8 h
Number of significant shocks:	1 per 24 h

A3. *Example No. 3*

The product is intended for portable and non-stationary use.

Environmental classification :	7K4/7Z2/7Z6/7Z10/7B2/7C3/7S3/7M3
Duration of use:	5 years
Duration of wetness (condensation, precipitation, spraying water):	2 months per year
Duration of significant influence of chemically active substances:	0.5 h per 24 h
Duration of icing, frosting:	1 month per year
Number of significant free falls:	2 per year

Standard Mark

The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS

Revision of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indin Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards Monthly Additions'. Comments on this Indian Standard may be sent to BIS giving the following reference:

Doc : No. LTD 02 (0017/BN)

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 11002
Telephones : 331 01 31, 331 13 75

Telegrams : Manaksanstha
Common to all Offices)

Regional Offices :	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	331 01 31 331 13 75
Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola CALCUTTA 700054	37 84 99, 37 85 61 37 86 26, 37 86 62
Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160036	53 38 43, 53 16 40 53 23 84
Southern : C. I. T. Campus, IV Cross Road, MADRAS 600113	235 02 16, 235 04 42 235 15 19, 235 23 15
Western : Manakalaya, E9 MIDC, Marol, Andheri (East) BOMBAY 400093	632 92 95, 632 78 58 632 78, 91, 632 78 92

Branch : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR LUCKNOW. PATNA. THIRUVANANTHAPURAM.

Printed at Printwell Printers, Aligarh, India